FIG. 1

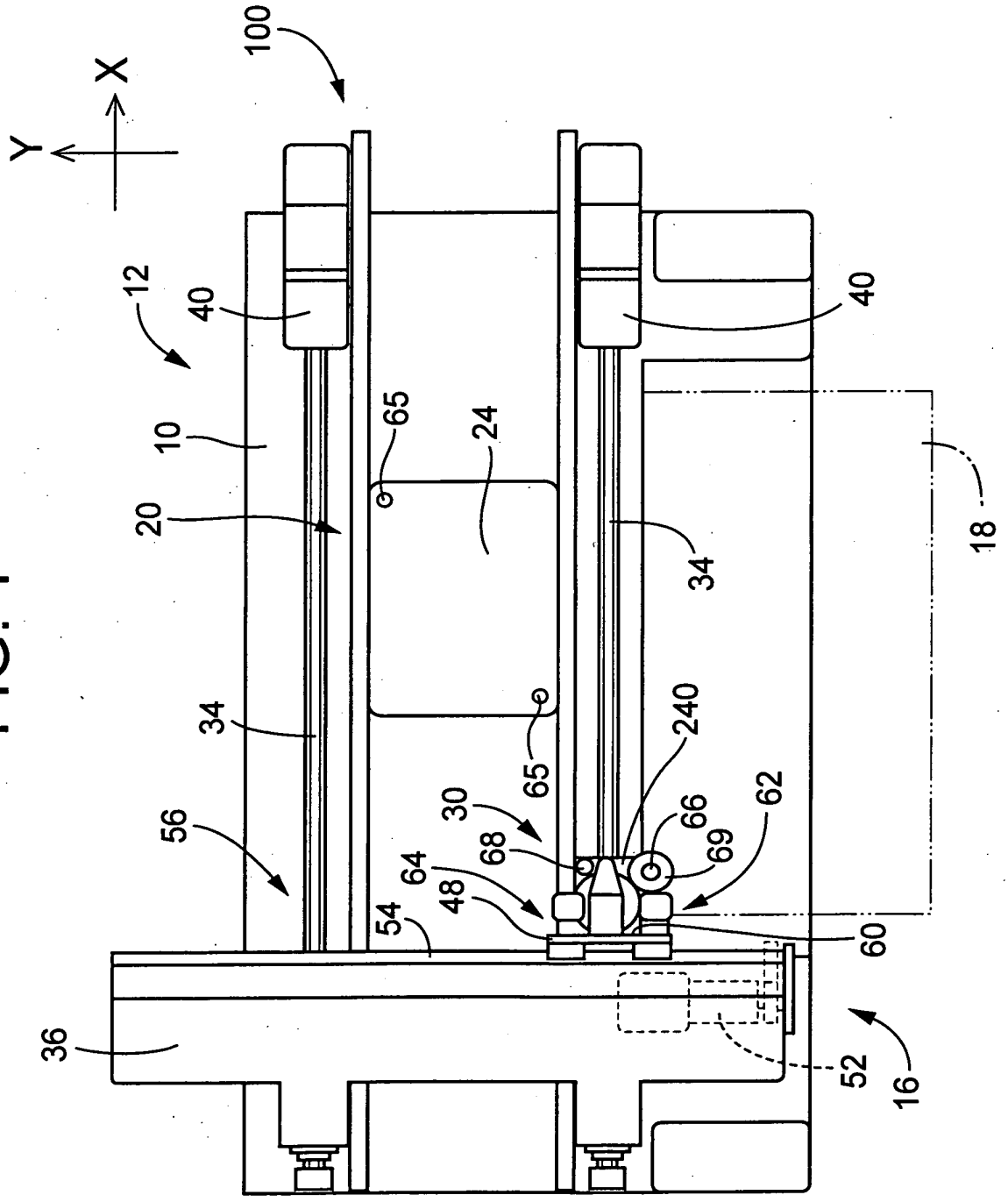
100
X
Y
12
40
40
10
65
24
20
34
18
34
65
240
30
66
62
56
68
69
64
48
54
60
36
52
16

FIG. 2

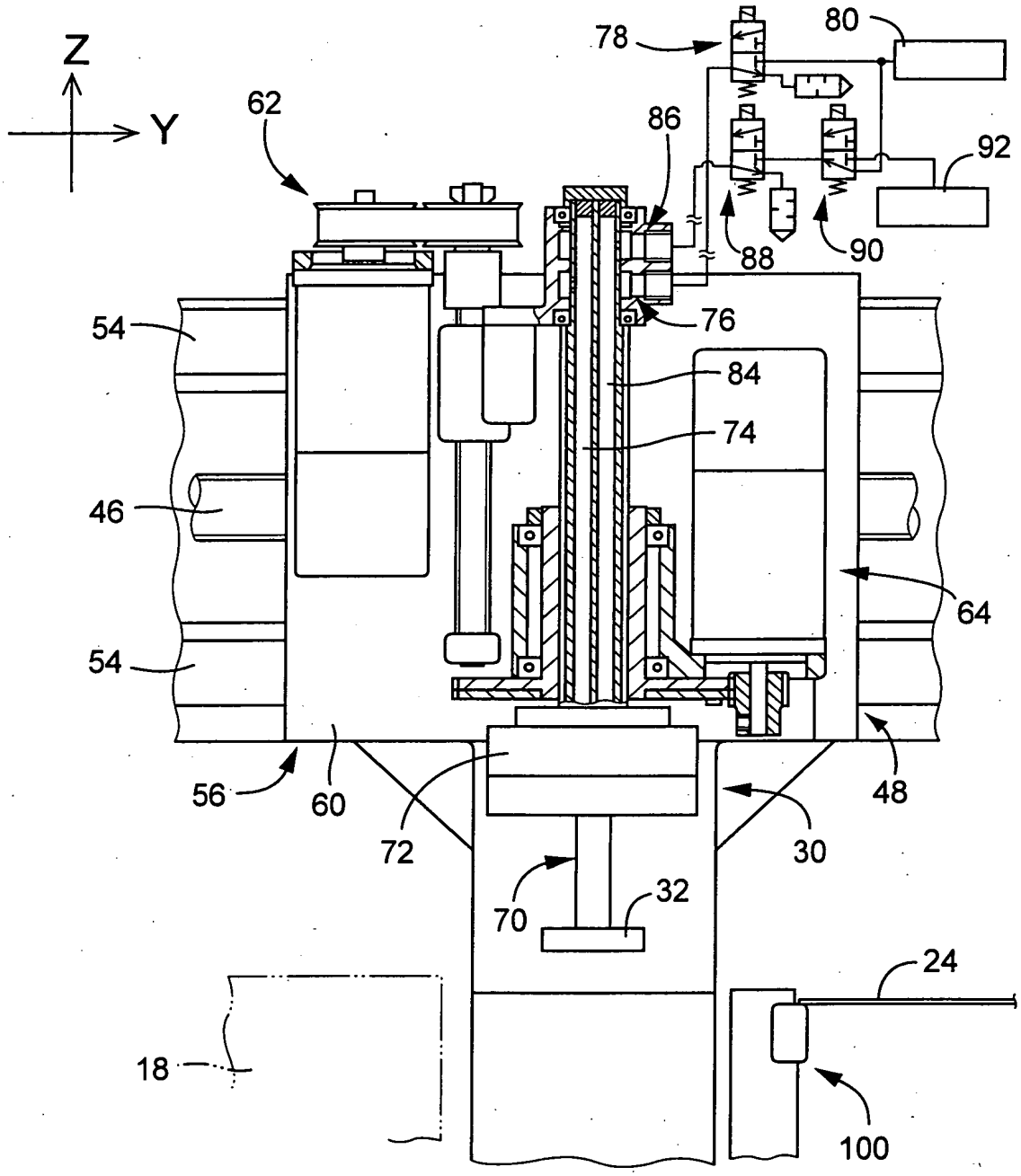
Z
Y
62
78
80
86
92
88
90
54
76
84
74
46
64
54
56
60
72
48
30
70
32
24
18
100

FIG. 3

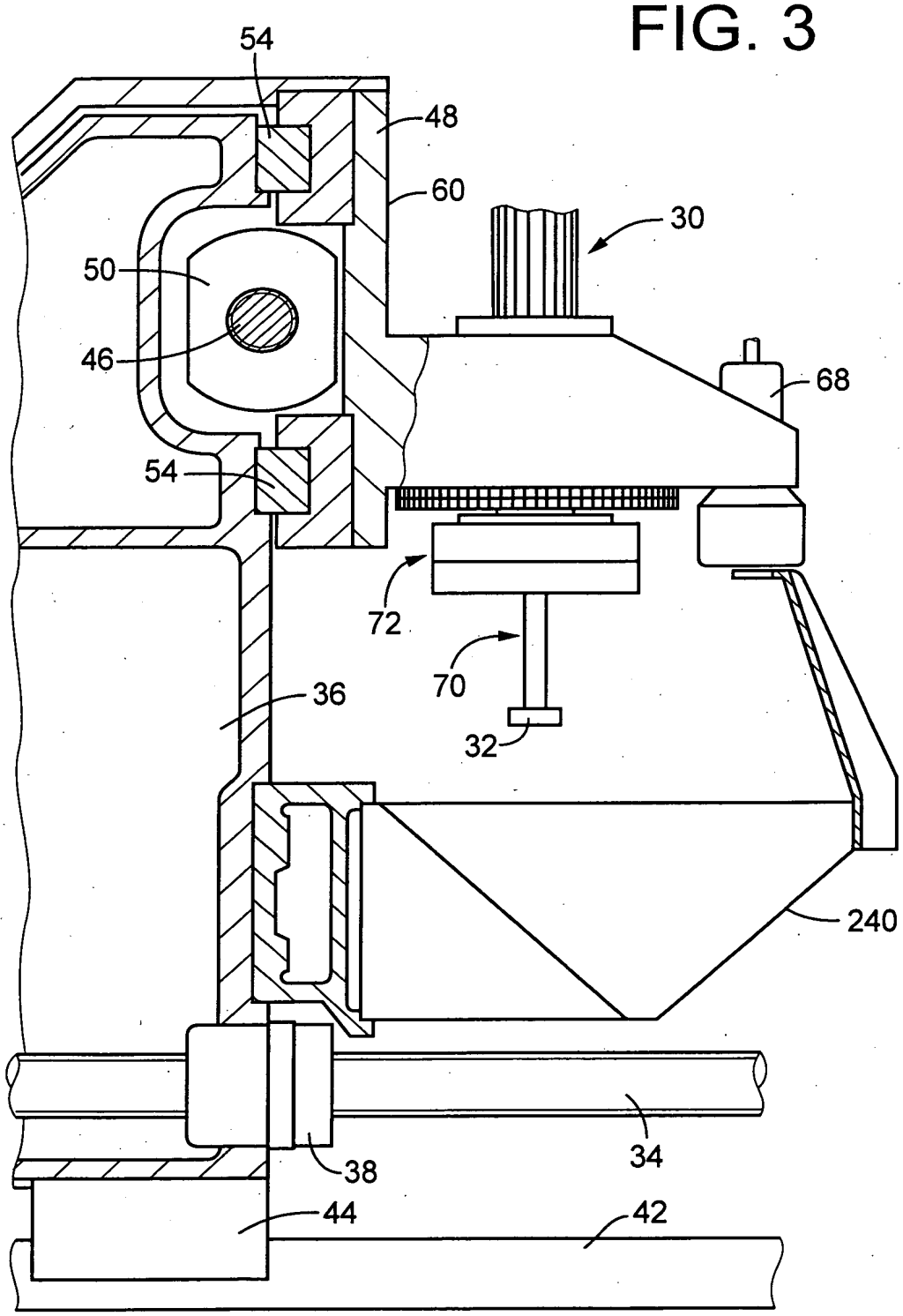

FIG. 4

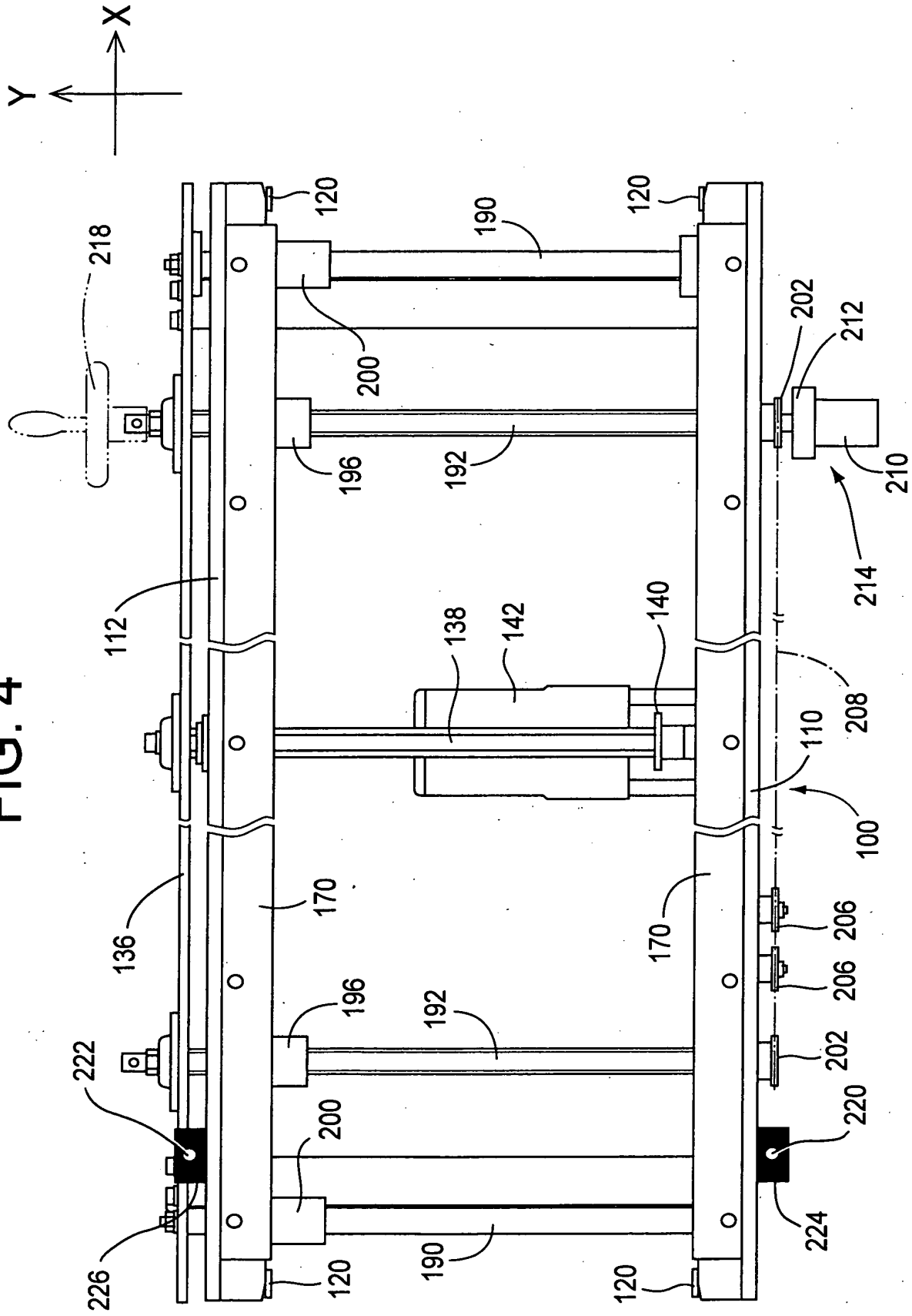
Y
X
218
120
190
120
202
212
200
196
192
210
214
112
138
142
140
208
110
100
136
170
170
206
206
196
192
222
202
200
220
226
190
224
120
120

FIG. 5

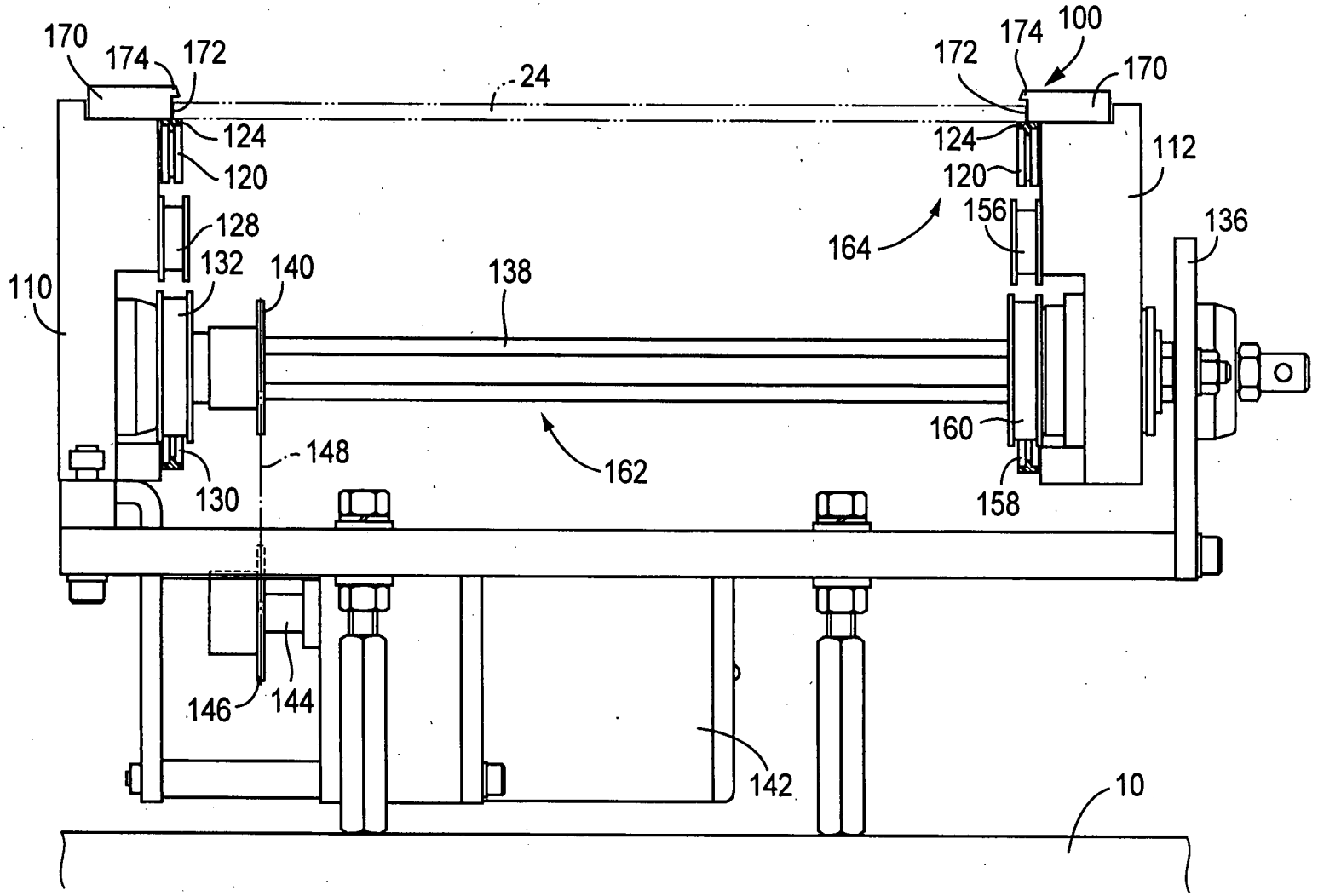
170
174
172
24
124
120
128
132
140
138
110
148
130
162
146
144
142
10
172
174
100
170
124
120
112
156
164
136
160
158

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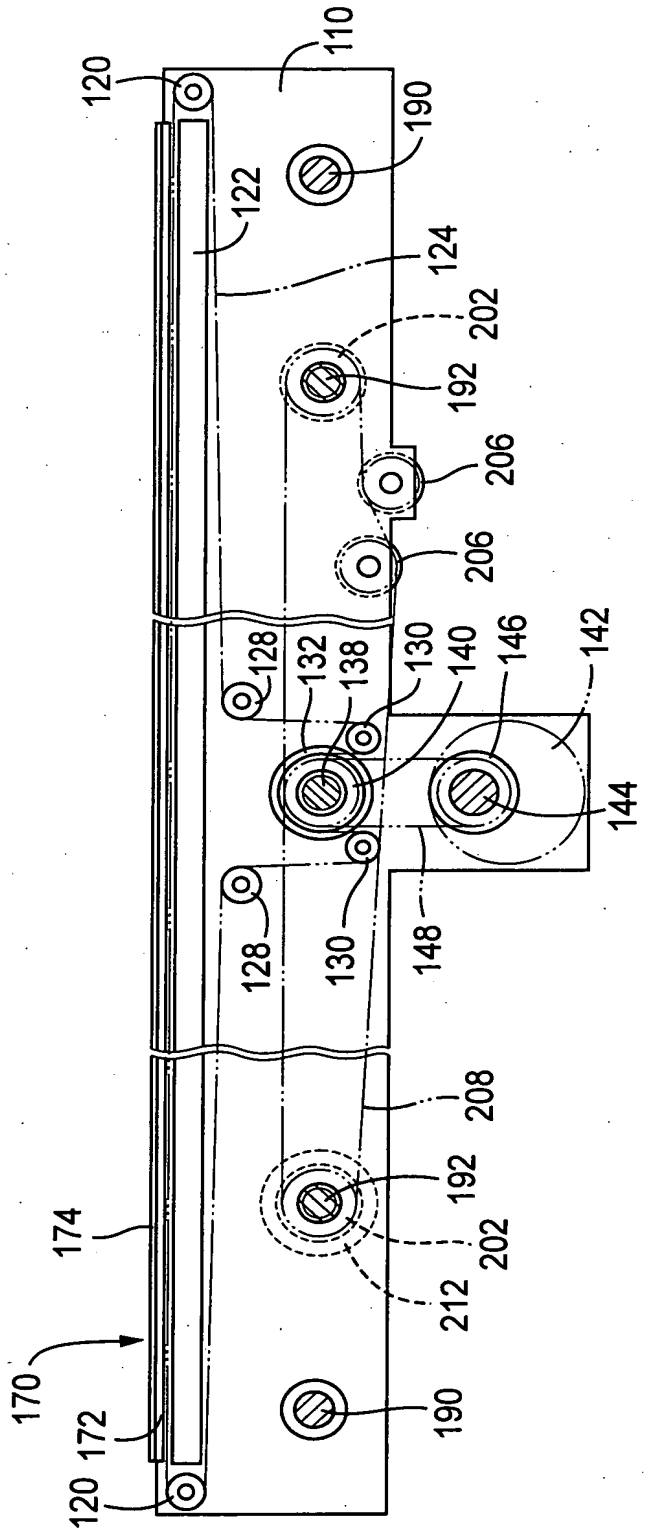
FIG. 6



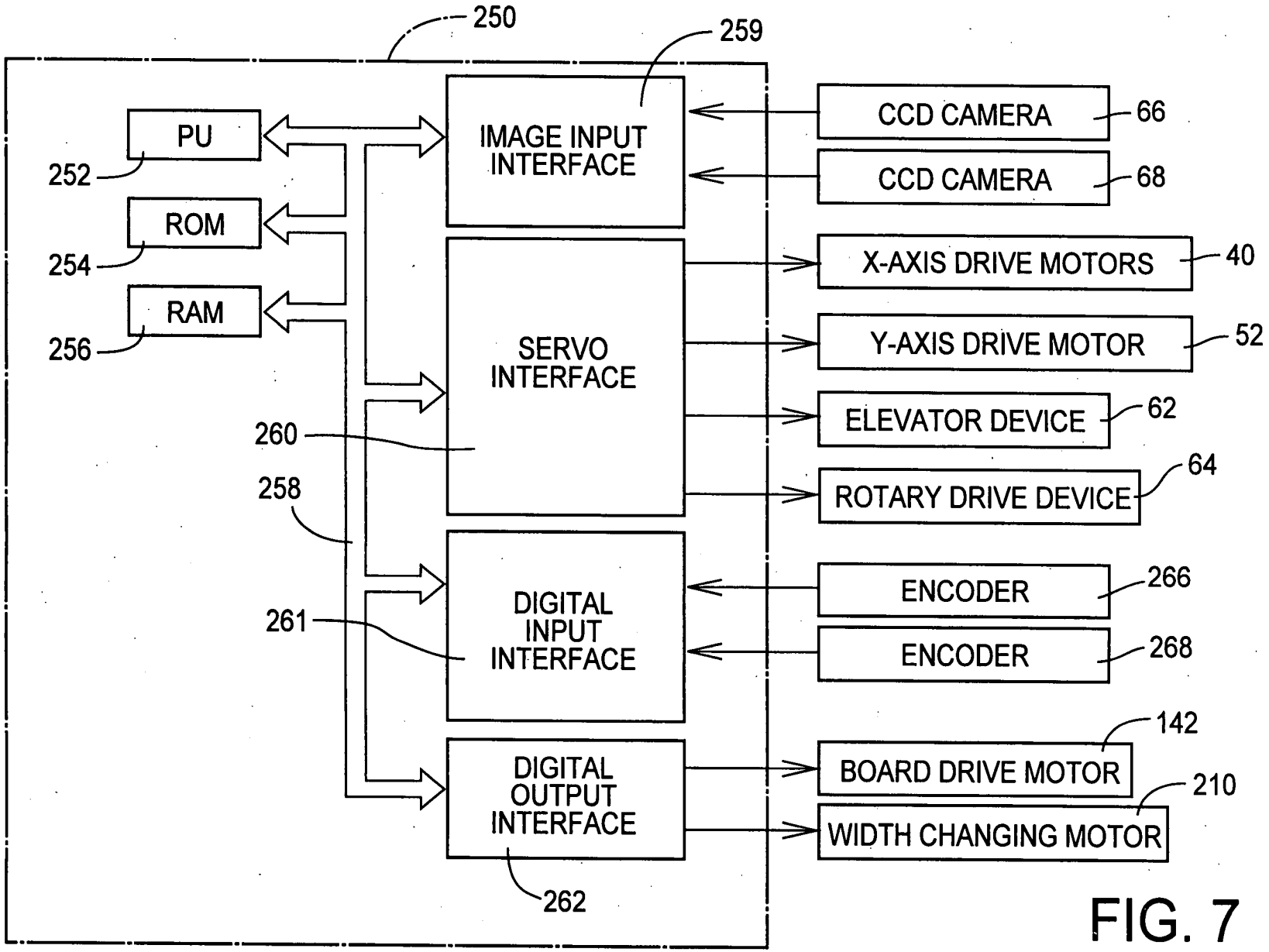

250
259
PU
252
ROM
254
RAM
256
IMAGE INPUT INTERFACE
SERVO INTERFACE
260
258
DIGITAL INPUT INTERFACE
261
DIGITAL OUTPUT INTERFACE
262
CCD CAMERA
66
CCD CAMERA
68
X-AXIS DRIVE MOTORS
40
Y-AXIS DRIVE MOTOR
52
ELEVATOR DEVICE
62
ROTARY DRIVE DEVICE
64
ENCODER
266
ENCODER
268
142
BOARD DRIVE MOTOR
210
WIDTH CHANGING MOTOR

FIG. 7

FIG. 8

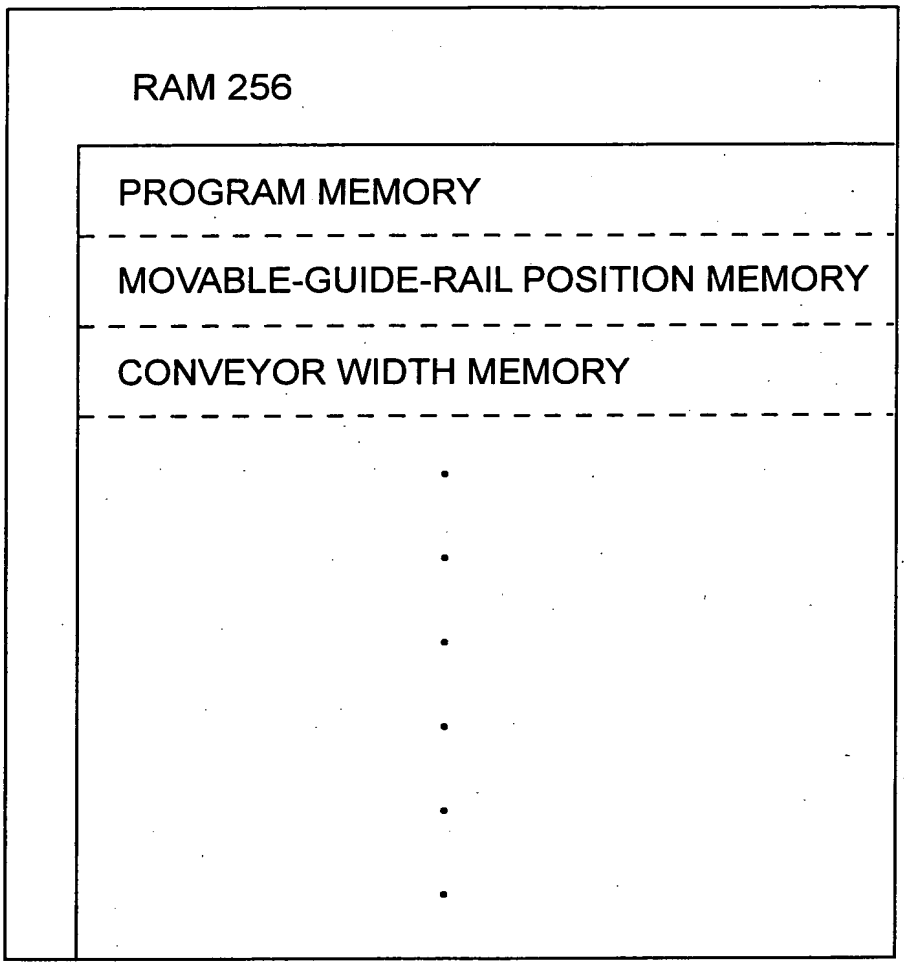

RAM 256
PROGRAM MEMORY
MOVABLE-GUIDE-RAIL POSITION MEMORY
CONVEYOR WIDTH MEMORY

FIG. 9

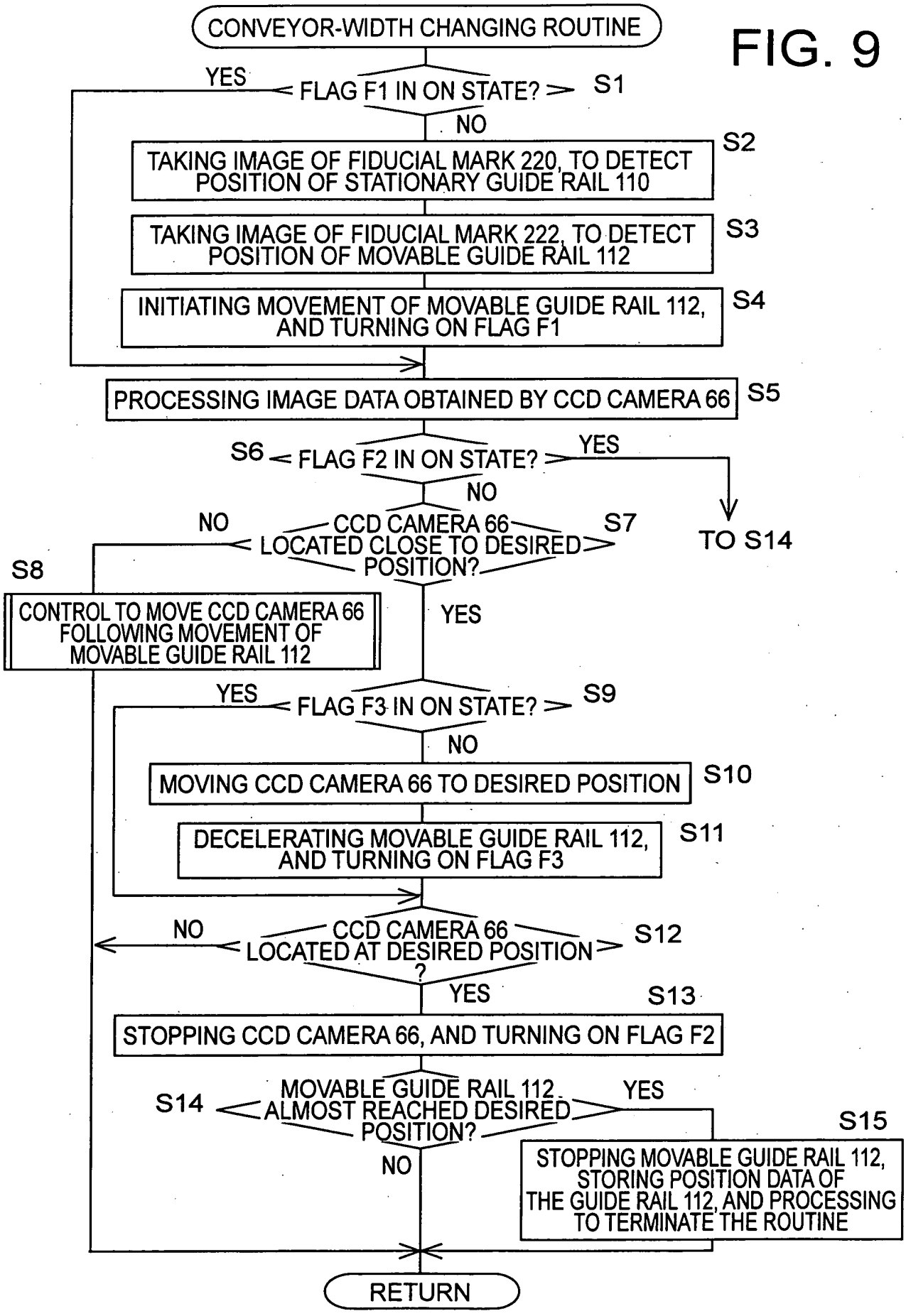

CONVEYOR-WIDTH CHANGING ROUTINE
FLAG F1 IN ON STATE?
YES
NO
S1
TAKING IMAGE OF FIDUCIAL MARK 220, TO DETECT POSITION OF STATIONARY GUIDE RAIL 110
S2
TAKING IMAGE OF FIDUCIAL MARK 222, TO DETECT POSITION OF MOVABLE GUIDE RAIL 112
S3
INITIATING MOVEMENT OF MOVABLE GUIDE RAIL 112, AND TURNING ON FLAG F1
S4
PROCESSING IMAGE DATA OBTAINED BY CCD CAMERA 66
S5
S6
FLAG F2 IN ON STATE?
YES
NO
TO S14
CCD CAMERA 66 LOCATED CLOSE TO DESIRED POSITION?
S7
NO
YES
S8
CONTROL TO MOVE CCD CAMERA 66 FOLLOWING MOVEMENT OF MOVABLE GUIDE RAIL 112
FLAG F3 IN ON STATE?
S9
YES
NO
MOVING CCD CAMERA 66 TO DESIRED POSITION
S10
DECELERATING MOVABLE GUIDE RAIL 112, AND TURNING ON FLAG F3
S11
CCD CAMERA 66 LOCATED AT DESIRED POSITION ?
S12
NO
YES
STOPPING CCD CAMERA 66, AND TURNING ON FLAG F2
S13
S14
MOVABLE GUIDE RAIL 112 ALMOST REACHED DESIRED POSITION?
YES
NO
S15
STOPPING MOVABLE GUIDE RAIL 112, STORING POSITION DATA OF THE GUIDE RAIL 112, AND PROCESSING TO TERMINATE THE ROUTINE
RETURN

FIG. 10

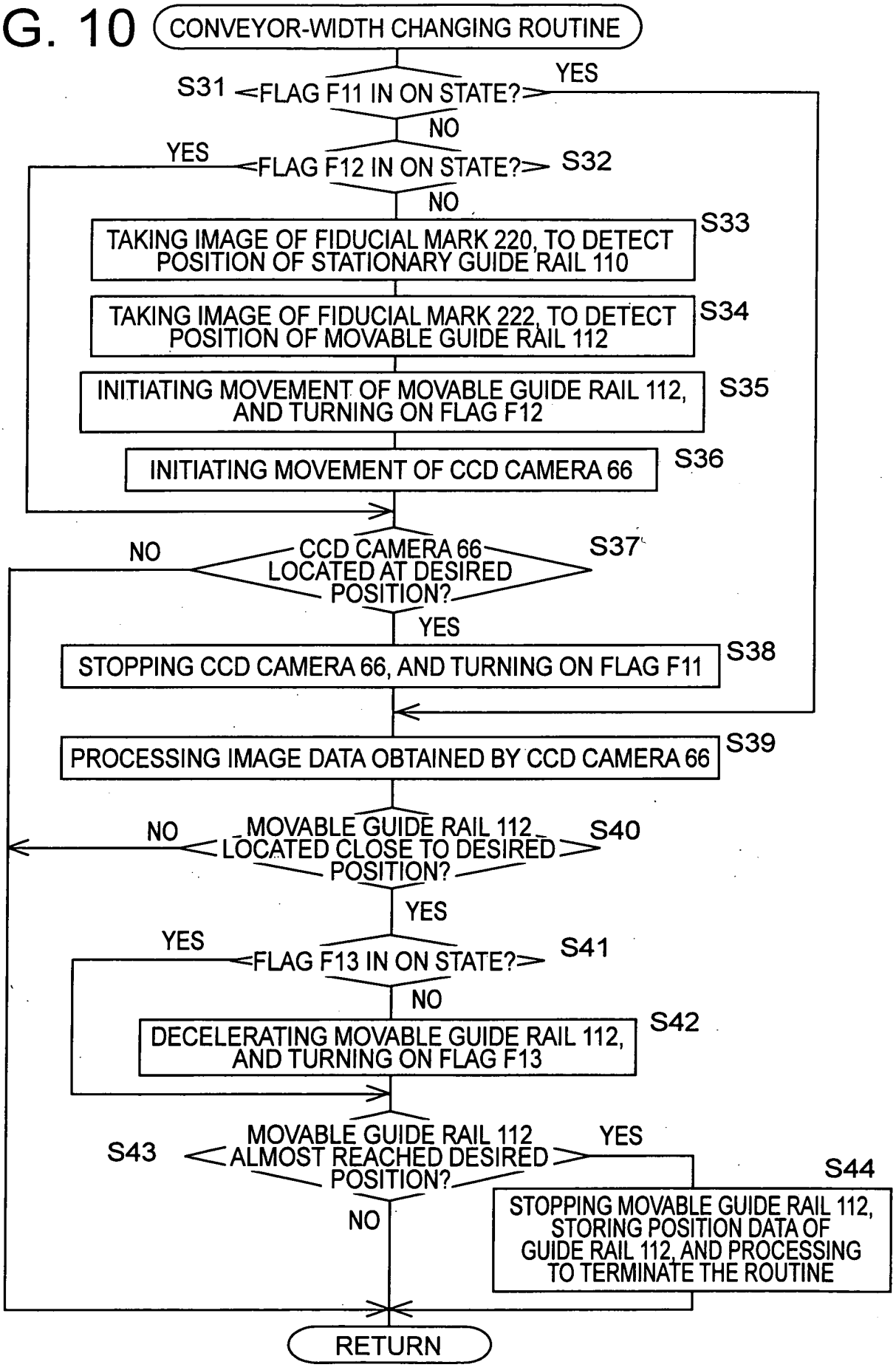

CONVEYOR-WIDTH CHANGING ROUTINE
S31
FLAG F11 IN ON STATE?
YES
NO
FLAG F12 IN ON STATE?
S32
YES
NO
TAKING IMAGE OF FIDUCIAL MARK 220, TO DETECT POSITION OF STATIONARY GUIDE RAIL 110
S33
TAKING IMAGE OF FIDUCIAL MARK 222, TO DETECT POSITION OF MOVABLE GUIDE RAIL 112
S34
INITIATING MOVEMENT OF MOVABLE GUIDE RAIL 112, AND TURNING ON FLAG F12
S35
INITIATING MOVEMENT OF CCD CAMERA 66
S36
CCD CAMERA 66 LOCATED AT DESIRED POSITION?
S37
NO
YES
STOPPING CCD CAMERA 66, AND TURNING ON FLAG F11
S38
PROCESSING IMAGE DATA OBTAINED BY CCD CAMERA 66
S39
MOVABLE GUIDE RAIL 112 LOCATED CLOSE TO DESIRED POSITION?
S40
NO
YES
FLAG F13 IN ON STATE?
S41
YES
NO
DECELERATING MOVABLE GUIDE RAIL 112, AND TURNING ON FLAG F13
S42
MOVABLE GUIDE RAIL 112 ALMOST REACHED DESIRED POSITION?
S43
YES
NO
S44
STOPPING MOVABLE GUIDE RAIL 112, STORING POSITION DATA OF GUIDE RAIL 112, AND PROCESSING TO TERMINATE THE ROUTINE
RETURN

FIG. 11

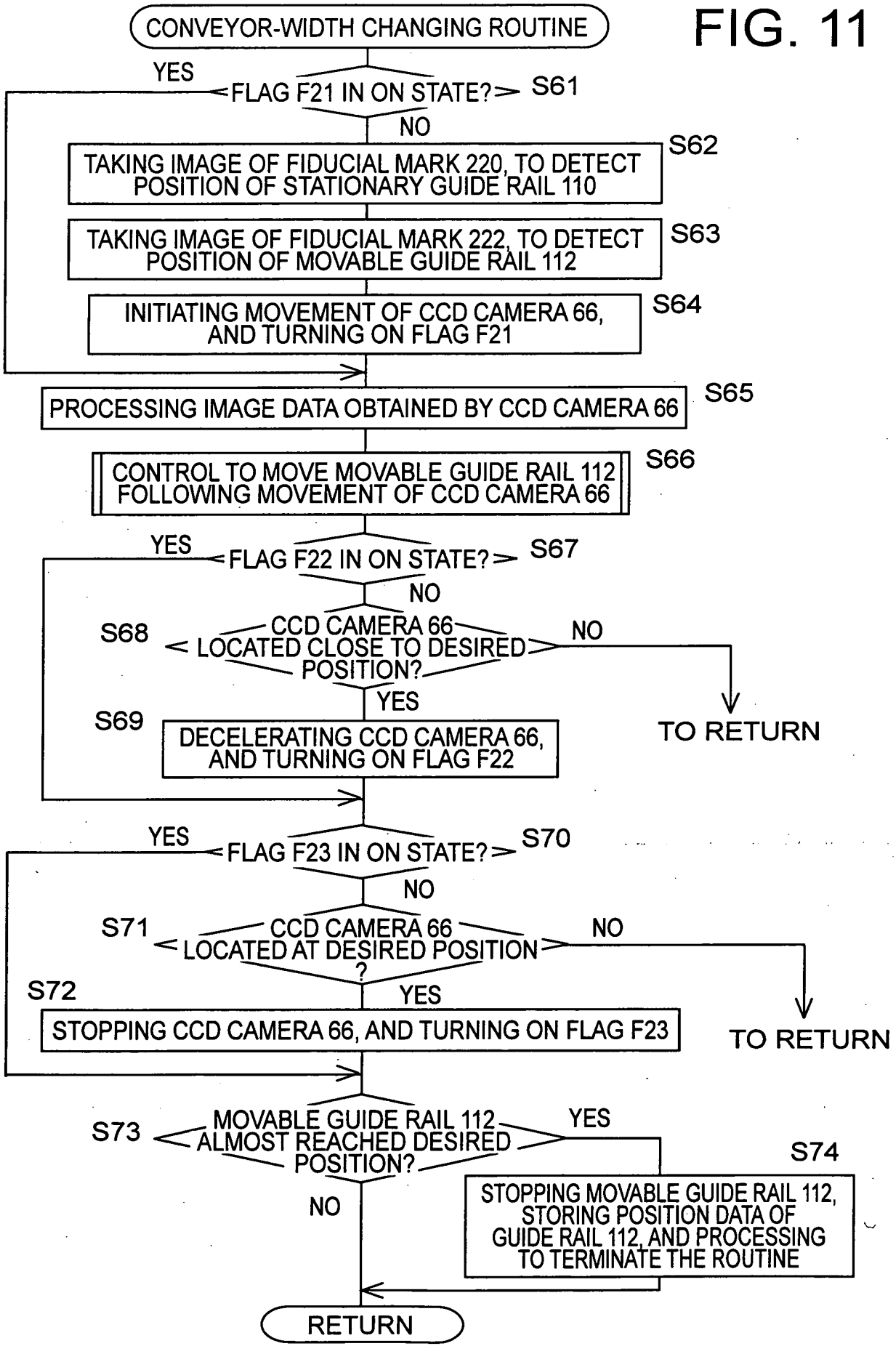
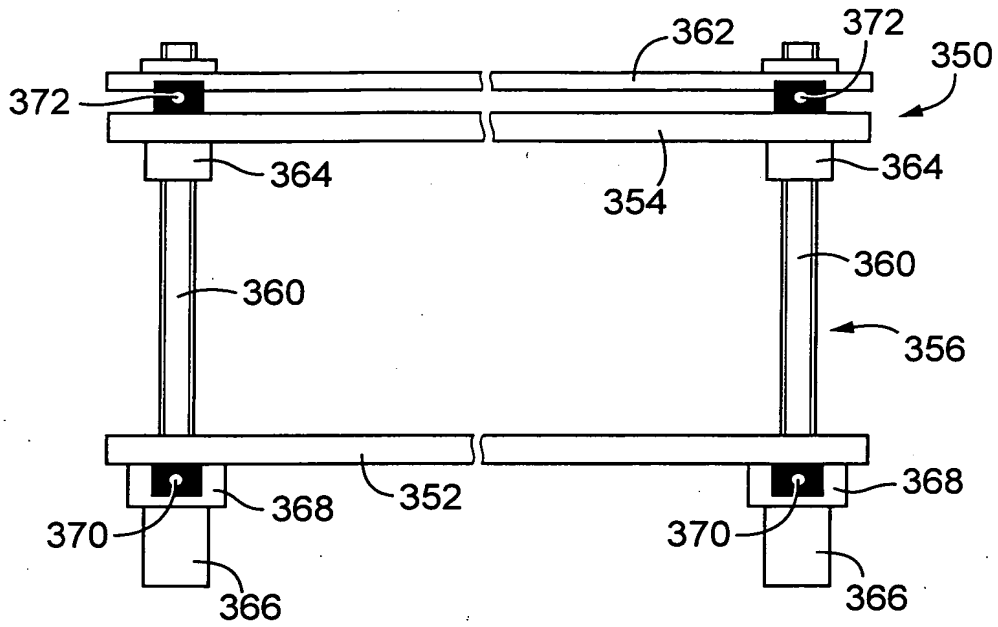

CONVEYOR-WIDTH CHANGING ROUTINE
FLAG F21 IN ON STATE?
YES
S61
NO
TAKING IMAGE OF FIDUCIAL MARK 220, TO DETECT POSITION OF STATIONARY GUIDE RAIL 110
S62
TAKING IMAGE OF FIDUCIAL MARK 222, TO DETECT POSITION OF MOVABLE GUIDE RAIL 112
S63
INITIATING MOVEMENT OF CCD CAMERA 66, AND TURNING ON FLAG F21
S64
PROCESSING IMAGE DATA OBTAINED BY CCD CAMERA 66
S65
CONTROL TO MOVE MOVABLE GUIDE RAIL 112 FOLLOWING MOVEMENT OF CCD CAMERA 66
S66
FLAG F22 IN ON STATE?
YES
S67
NO
CCD CAMERA 66 LOCATED CLOSE TO DESIRED POSITION?
S68
NO
YES
TO RETURN
DECELERATING CCD CAMERA 66, AND TURNING ON FLAG F22
S69
FLAG F23 IN ON STATE?
YES
S70
NO
CCD CAMERA 66 LOCATED AT DESIRED POSITION ?
S71
NO
YES
TO RETURN
STOPPING CCD CAMERA 66, AND TURNING ON FLAG F23
S72
MOVABLE GUIDE RAIL 112 ALMOST REACHED DESIRED POSITION?
S73
YES
NO
STOPPING MOVABLE GUIDE RAIL 112, STORING POSITION DATA OF GUIDE RAIL 112, AND PROCESSING TO TERMINATE THE ROUTINE
S74
RETURN

FIG. 12


362
372
350
372
364
364
354
360
360
356
368
352
368
370
370
366
366

T0902T' 9806000T

FIG. 13

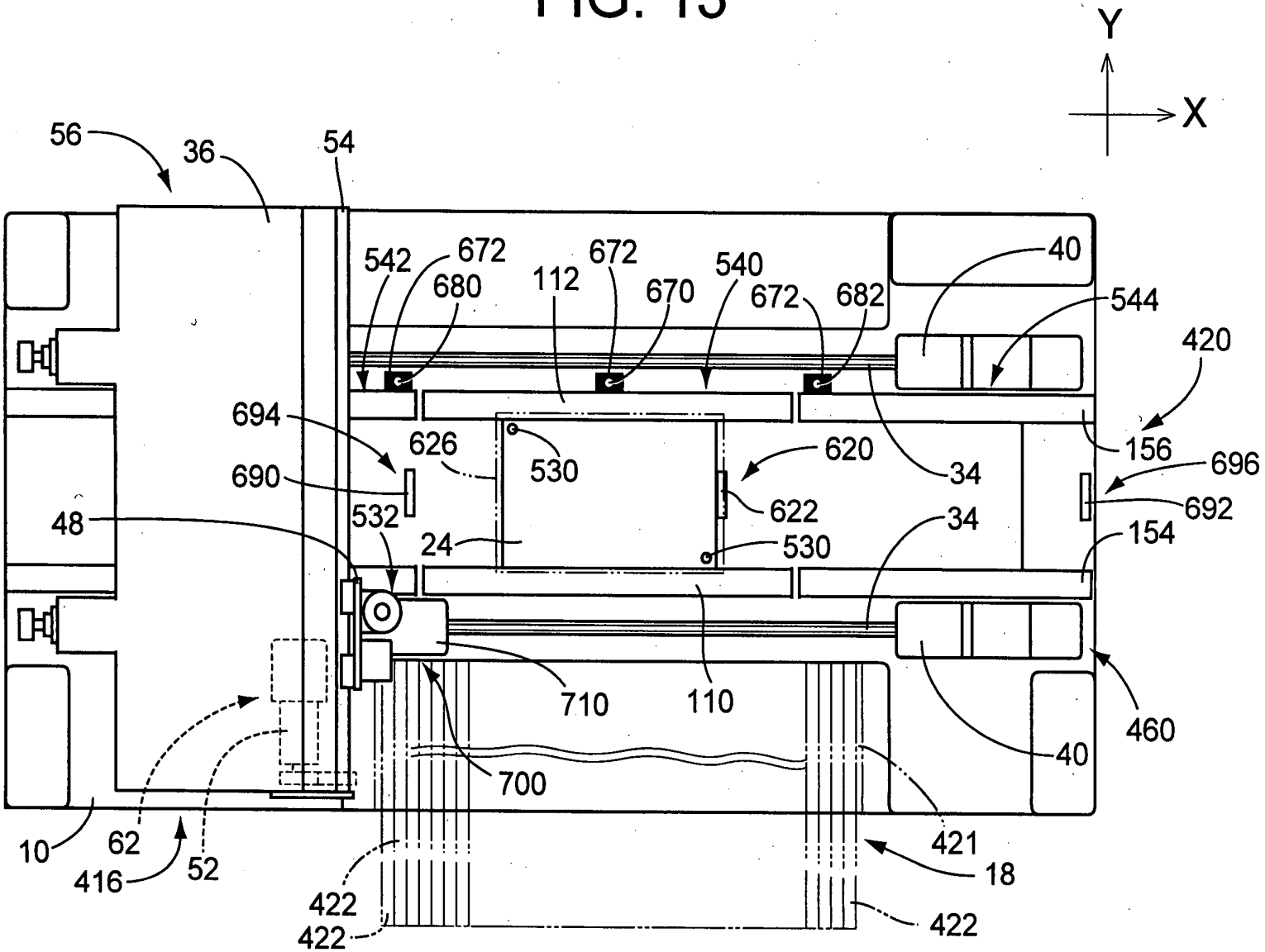


FIG. 14

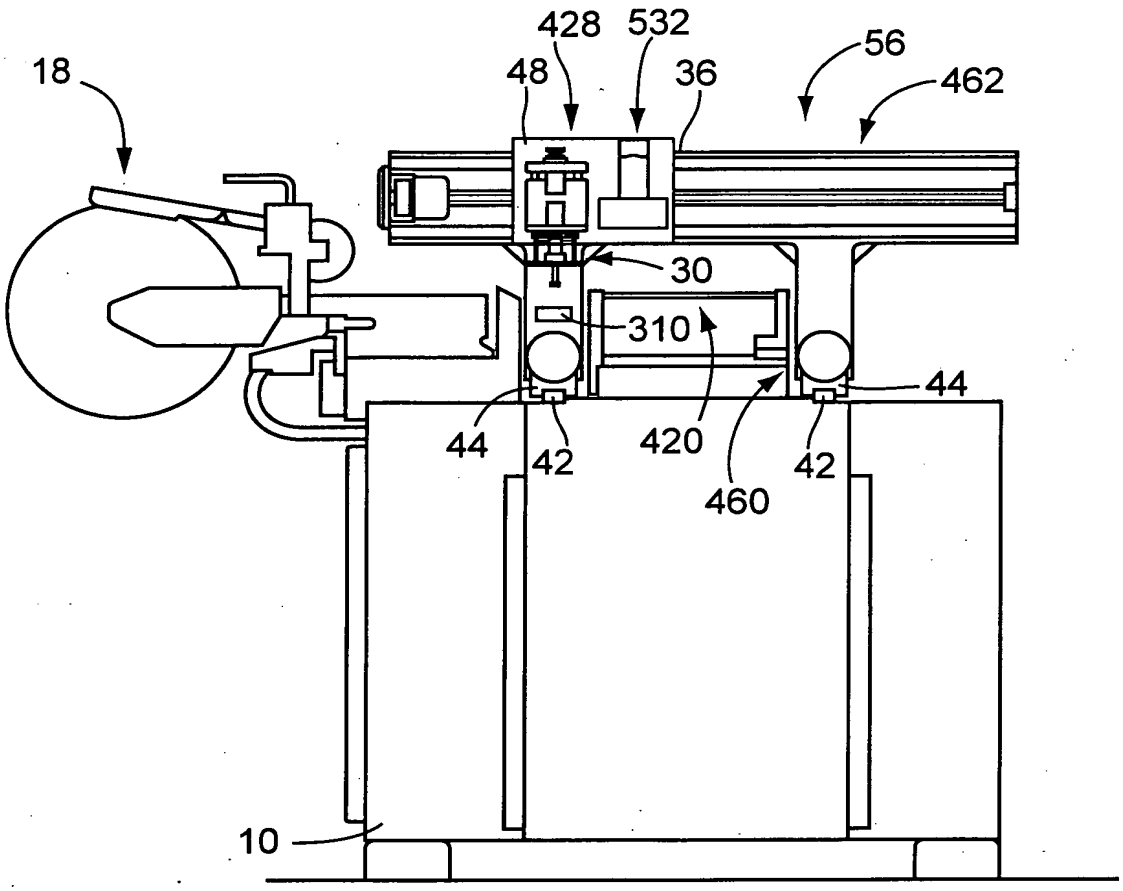


FIG. 15

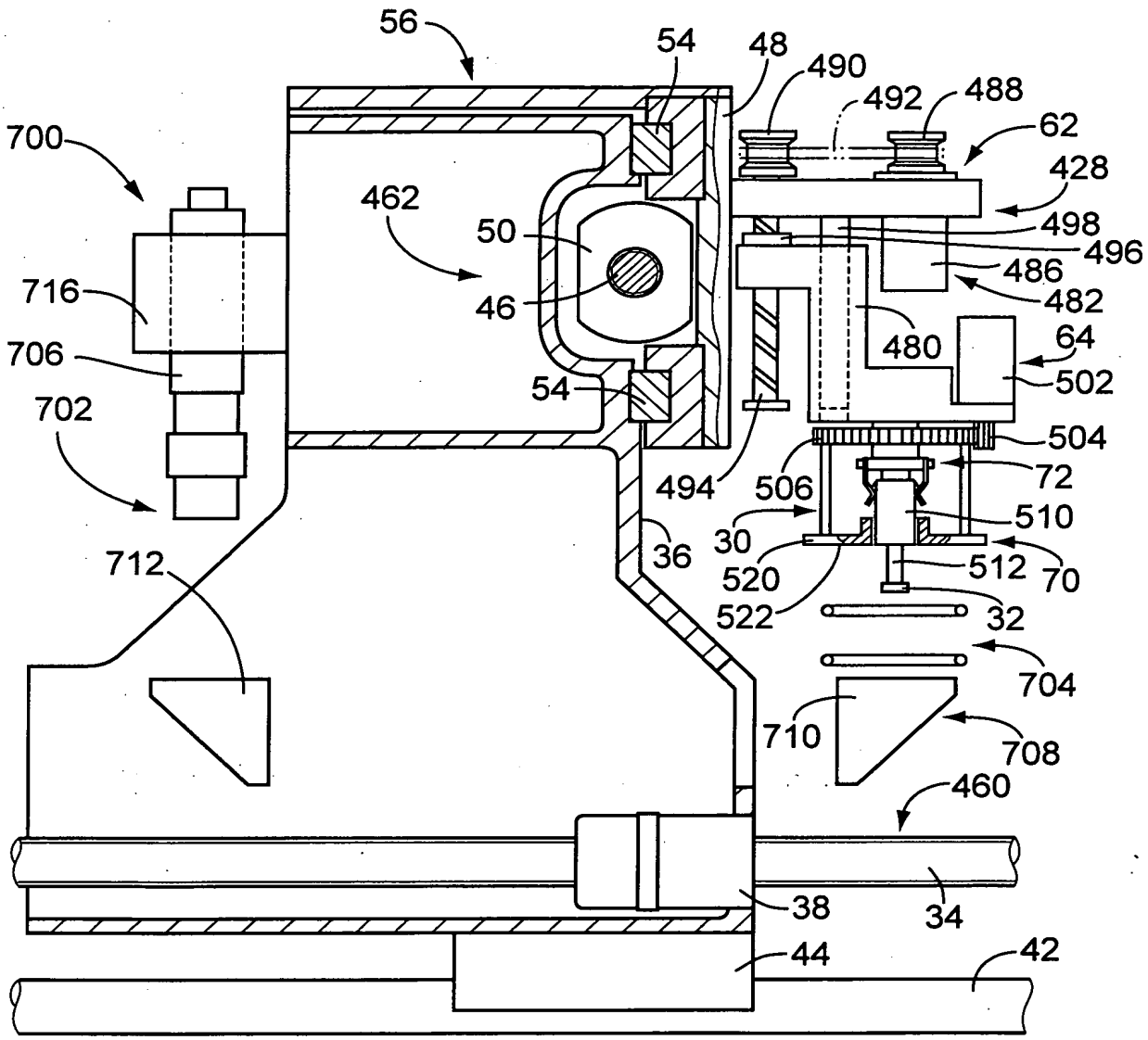

56
54
48
490
492
488
62
428
700
462
50
498
496
716
46
486
482
706
480
64
54
502
702
494
506
504
72
510
30
36
520
512
70
712
522
32
704
710
708
460
38
34
44
42

FIG. 16

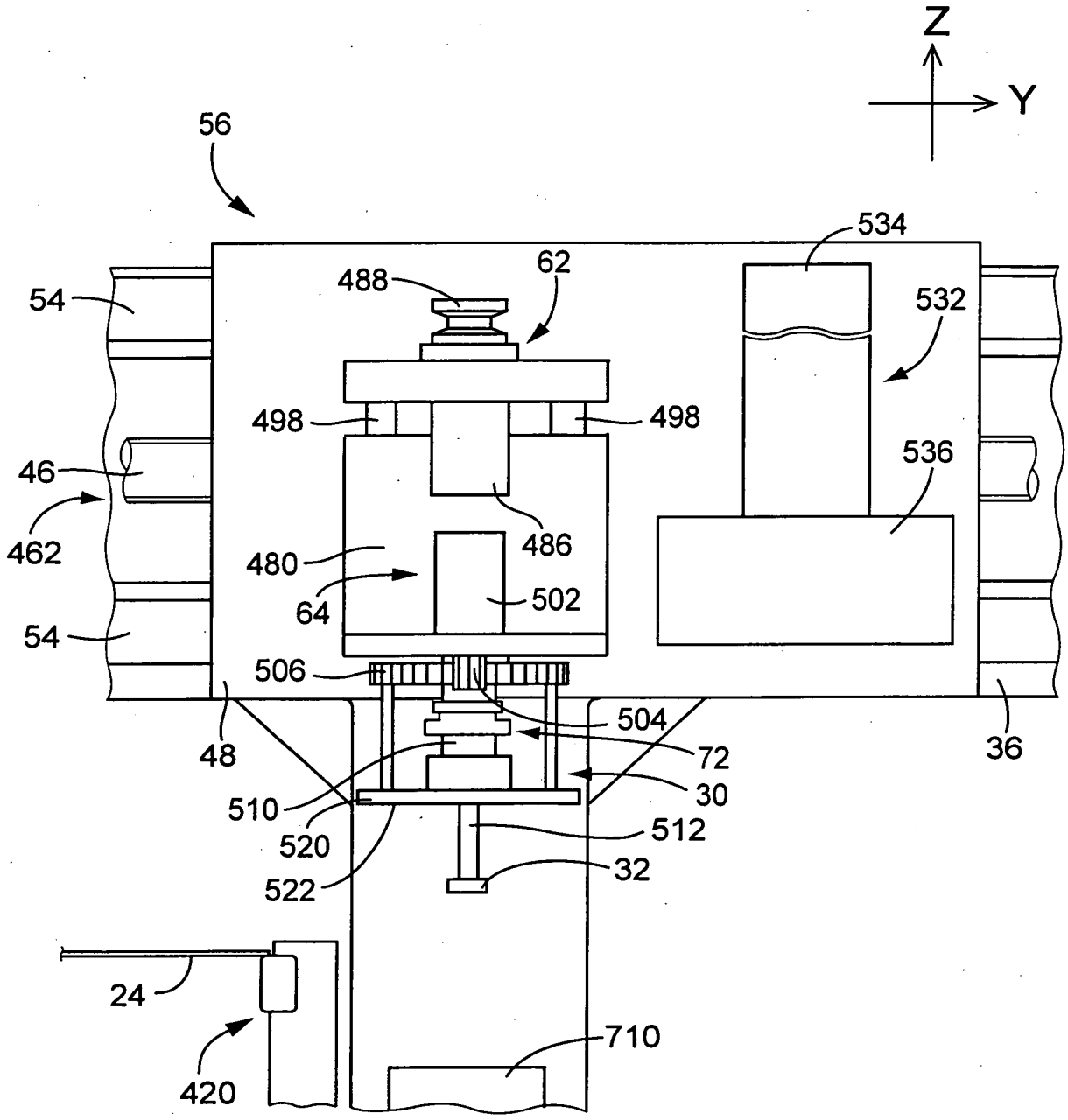
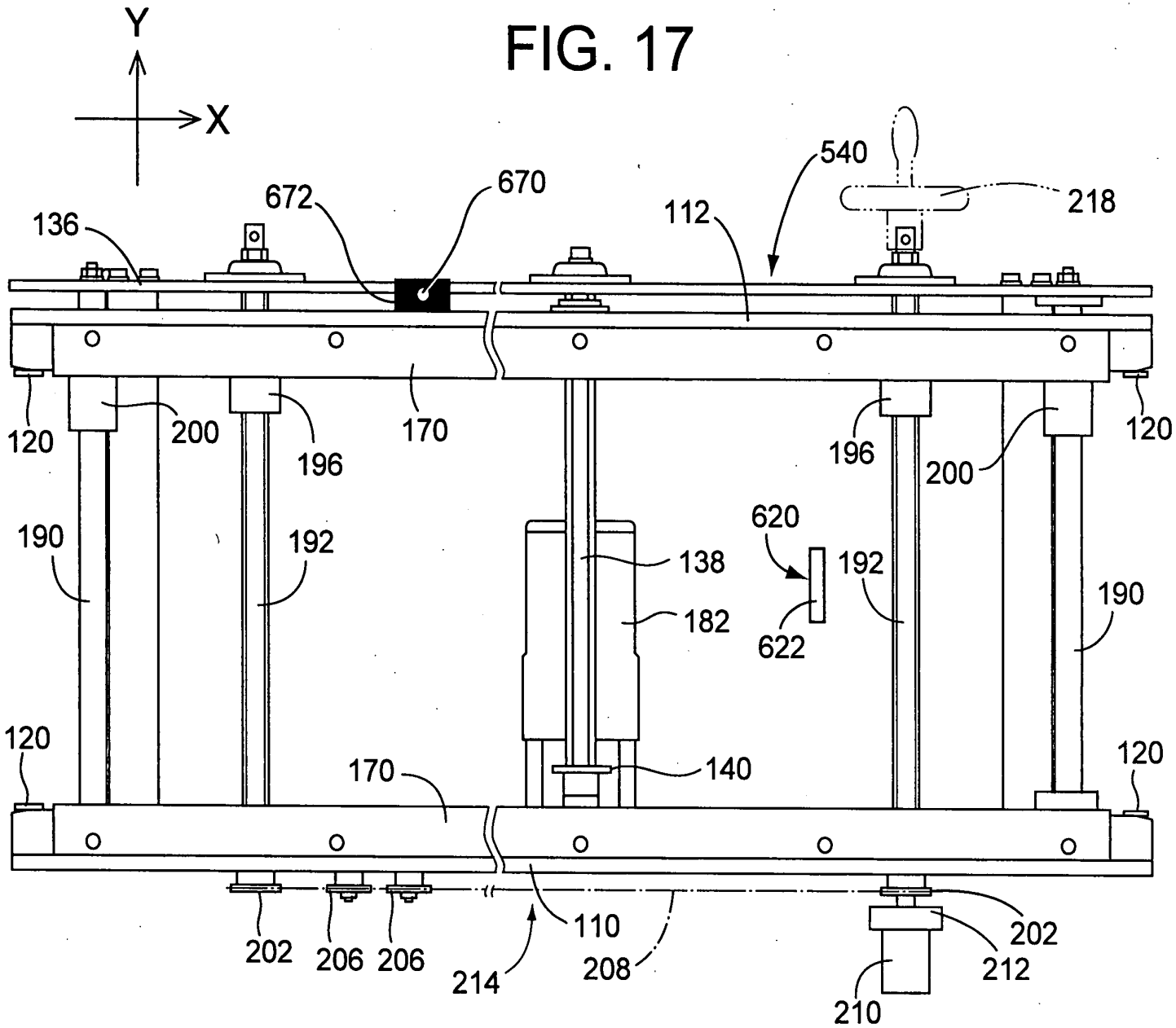

Z
Y
56
534
62
488
54
532
498
498
46
536
462
486
480
64
502
54
506
504
48
72
36
30
510
512
520
32
522
24
710
420

FIG. 17


Y
X
540
218
672
670
136
112
120
200
196
170
196
200
120
190
192
620
138
192
190
182
622
120
170
140
120
202
206
206
214
110
208
202
212
210

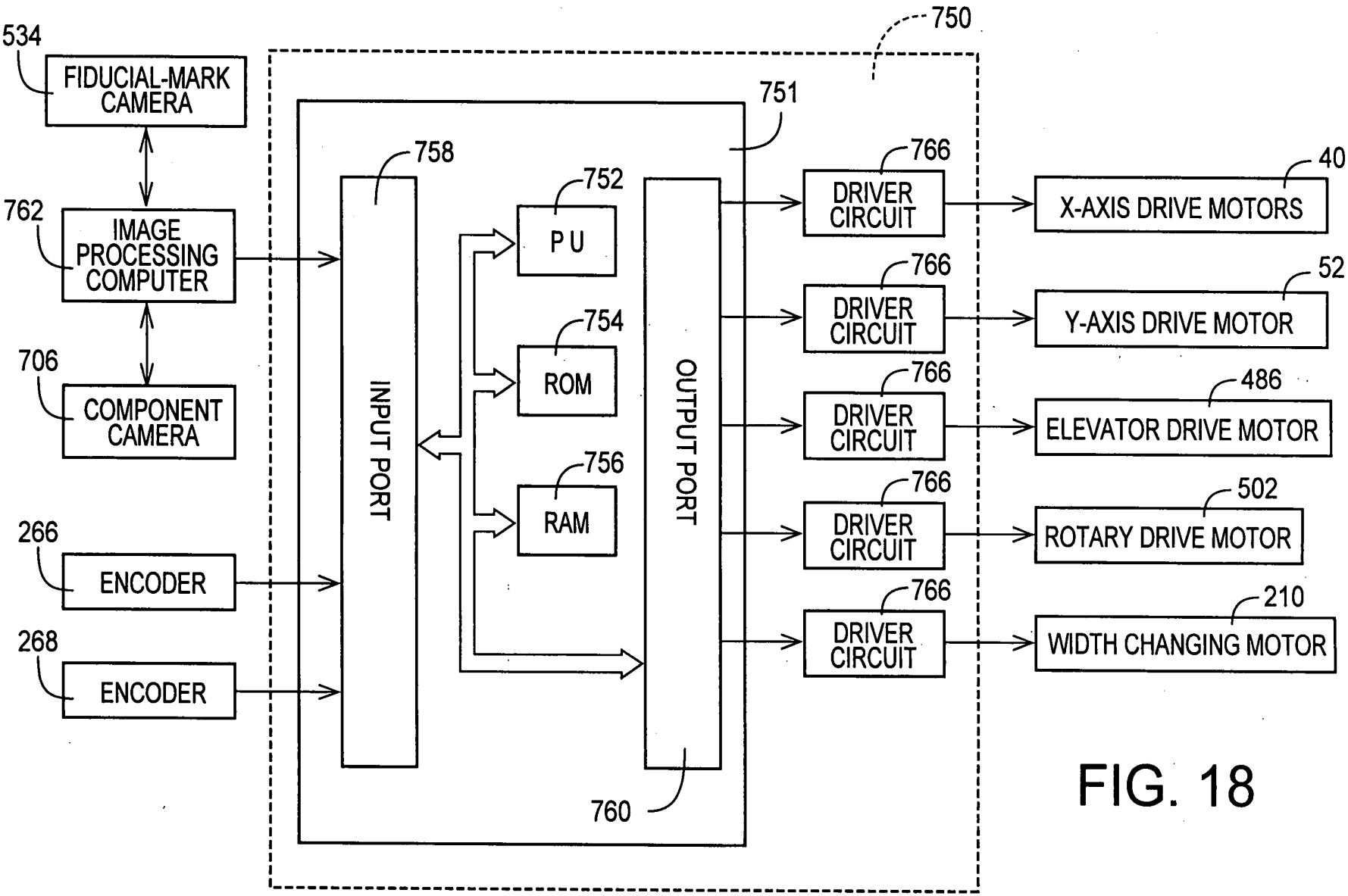

534
FIDUCIAL-MARK CAMERA
762
IMAGE PROCESSING COMPUTER
706
COMPONENT CAMERA
266
ENCODER
268
ENCODER
750
751
758
INPUT PORT
752
P U
754
ROM
756
RAM
760
OUTPUT PORT
766
DRIVER CIRCUIT
766
DRIVER CIRCUIT
766
DRIVER CIRCUIT
766
DRIVER CIRCUIT
766
DRIVER CIRCUIT
40
X-AXIS DRIVE MOTORS
52
Y-AXIS DRIVE MOTOR
486
ELEVATOR DRIVE MOTOR
502
ROTARY DRIVE MOTOR
210
WIDTH CHANGING MOTOR

FIG. 18

FIG. 19

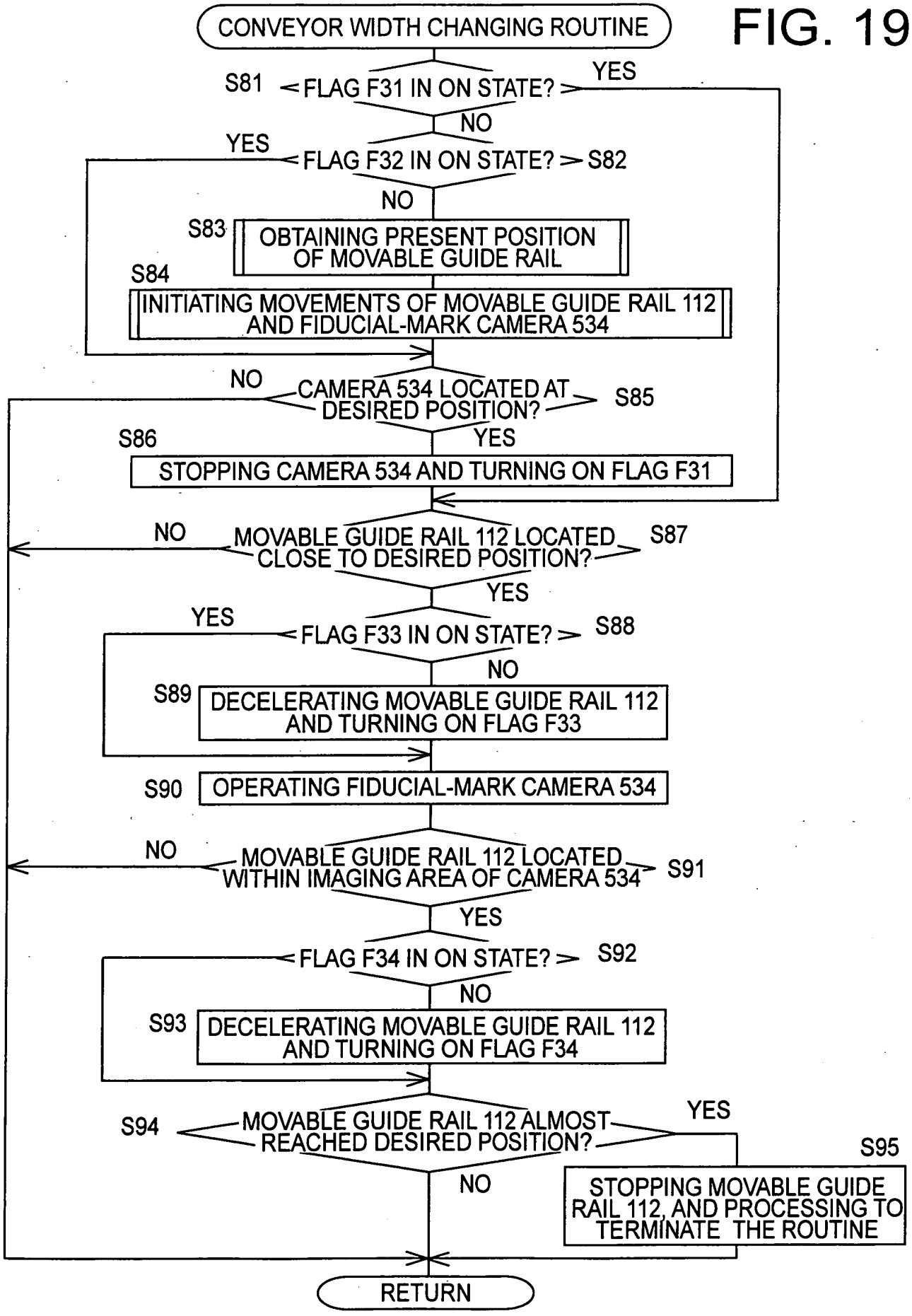
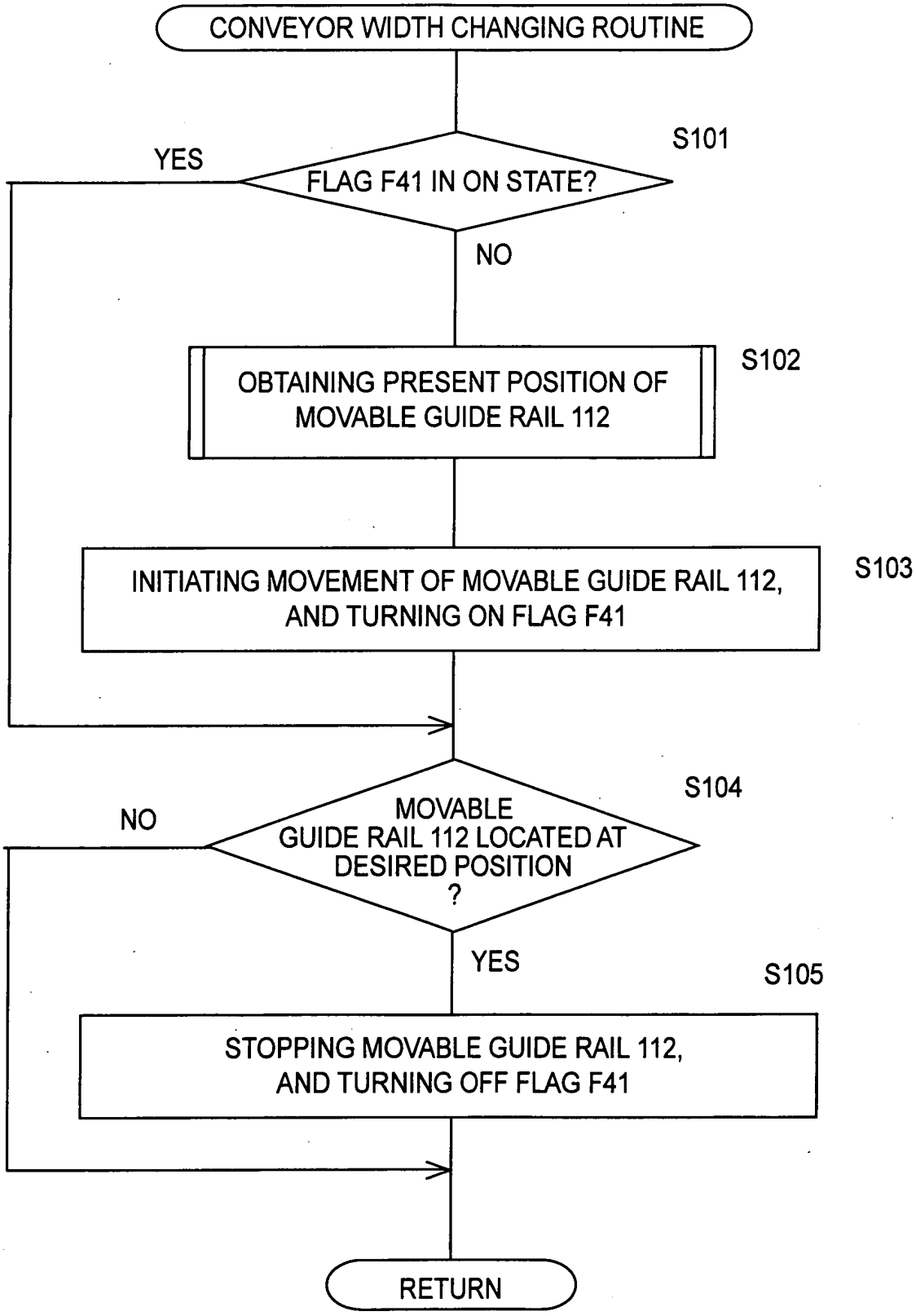

CONVEYOR WIDTH CHANGING ROUTINE
S81
FLAG F31 IN ON STATE?
YES
NO
YES
FLAG F32 IN ON STATE?
S82
NO
S83
OBTAINING PRESENT POSITION OF MOVABLE GUIDE RAIL
S84
INITIATING MOVEMENTS OF MOVABLE GUIDE RAIL 112 AND FIDUCIAL-MARK CAMERA 534
NO
CAMERA 534 LOCATED AT DESIRED POSITION?
S85
S86
YES
STOPPING CAMERA 534 AND TURNING ON FLAG F31
NO
MOVABLE GUIDE RAIL 112 LOCATED CLOSE TO DESIRED POSITION?
S87
YES
YES
FLAG F33 IN ON STATE?
S88
NO
S89
DECELERATING MOVABLE GUIDE RAIL 112 AND TURNING ON FLAG F33
S90
OPERATING FIDUCIAL-MARK CAMERA 534
NO
MOVABLE GUIDE RAIL 112 LOCATED WITHIN IMAGING AREA OF CAMERA 534
S91
YES
FLAG F34 IN ON STATE?
S92
NO
S93
DECELERATING MOVABLE GUIDE RAIL 112 AND TURNING ON FLAG F34
S94
MOVABLE GUIDE RAIL 112 ALMOST REACHED DESIRED POSITION?
YES
S95
NO
STOPPING MOVABLE GUIDE RAIL 112, AND PROCESSING TO TERMINATE THE ROUTINE
RETURN

FIG. 20


CONVEYOR WIDTH CHANGING ROUTINE
S101
YES
FLAG F41 IN ON STATE?
NO
S102
OBTAINING PRESENT POSITION OF MOVABLE GUIDE RAIL 112
S103
INITIATING MOVEMENT OF MOVABLE GUIDE RAIL 112, AND TURNING ON FLAG F41
S104
NO
MOVABLE GUIDE RAIL 112 LOCATED AT DESIRED POSITION ?
YES
S105
STOPPING MOVABLE GUIDE RAIL 112, AND TURNING OFF FLAG F41
RETURN

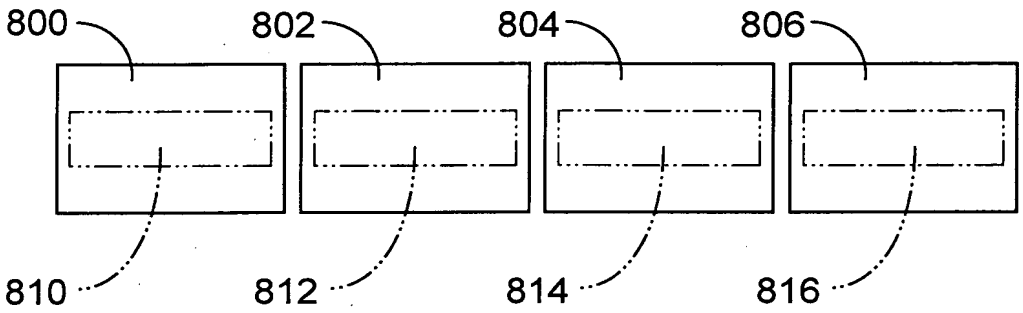



FIG. 21